

nearly realised, but the gradual absorption, by the liquid, of reduction products, tends to cause a deviation from this result.

BERTHELOT has recently studied (*Compt. rend.*) the action of air and of hydrochloric acid in presence of air, on pure mercury. He confirms the generally accepted fact that pure mercury is very slowly and superficially oxidised by the action of air at ordinary temperatures. If gaseous hydrochloric acid is shaken with mercury in presence of air mercurous chloride and water are produced. This reaction ($\text{Hg}_2 + 2\text{HCl} + \text{O} = \text{Hg}_2\text{Cl}_2 + \text{H}_2\text{O}$) is attended with the evolution of 53,400 thermal units, whereas the oxidation of mercury ($\text{Hg} + \text{O} = \text{HgO}$) is attended with the evolution of only 21,100 units. The action of hydrochloric acid in presence of air on copper ($\text{Cu}_2 + 2\text{HCl} + \text{O} = \text{Cu}_2\text{Cl}_2 + \text{H}_2\text{O}$) is accompanied by the evolution of 26,500 thermal units, hydrochloric acid in absence of air is, as is well known, almost without action on metallic copper.

In the course of his investigation into the action of phosphorus on hydriodic acid, Damoiseau (*Compt. rend.*) describes a method for preparing phosphonium iodide in a state sufficiently pure for general use. Ten parts ordinary phosphorus in small pieces are allowed to react for some time on twenty-two parts of an aqueous solution of hydriodic acid (saturated in the cold); two parts iodine are added, and the phosphorous acid which is produced is separated from the crystals of phosphonium iodide by washing with aqueous hydriodic acid.

A SERIES of compounds, derived from monohydric alcohols, in which the "hydroxylic hydrogen" of the alcohol is replaced by aluminium, is described (*Chem. News*) by Gladstone and Tribe. These bodies are prepared by the action of aluminium in presence of aluminium iodide on the alcohol. The new substances are solids, melting to clear liquids which do not solidify at temperatures much below the melting points of the solids; they are decomposed by water with formation of aluminium hydrate and the corresponding alcohol.

THE sulphides of vanadium have been investigated by Kay (*Chem. Soc. Journ.*). The compounds obtained by Berzelius by the action of sulphuretted hydrogen on solutions of vanadium salts are shown to contain oxygen in addition to vanadium and sulphur, but no definite formula can be assigned to any of these bodies. Vanadium trisulphide V_2S_3 is obtained by the action of dry sulphuretted hydrogen on heated vanadium trioxide, as described by Berzelius. When this compound is heated to bright redness in hydrogen, it is reduced to the disulphide V_2S_2 , and when heated with sulphur to 400° it is converted into the pentasulphide V_2S_5 .

IN the *Chem. Soc. Journ.* Kingzett describes experiments on the atmospheric oxidation of phosphorus which seem to prove that ozone and hydrogen peroxide are simultaneously produced when air is drawn over phosphorus partially immersed in water.

MANY so-called basic sulphates of iron have been from time to time described: of the fifteen which are generally recognised as probably existing it would appear from Pickering's experiments (*Chem. Soc. Journ.*) that only one, viz. $2\text{Fe}_2\text{O}_3 \cdot \text{SO}_3$, actually exists.

DR. SYDNEY MARSDEN has recently experimented on the action of boron on various metals at high temperatures. He finds (*Proc. R. S. Edin. and Chem. Soc. Journ.*) that silver dissolves amorphous boron, and that on cooling, pure boron is obtained partly in the graphitoid, partly in the adamantine form. Copper combines with boron to form the compound B_2Cu_3 .

PROF. BELLATI has published in pamphlet form, under the title "Proprietà termiche notevoli di alcuni Ioduri doppi," an extended and careful series of observations of the specific gravities, specific heats, thermal expansions, and thermal changes which accompany changes of colour and structure, of several double iodides of mercury, more especially of the three salts $\text{HgI}_2 \cdot 2\text{AgI}$, $\text{HgI}_2 \cdot 3\text{AgI}$, and $\text{HgI}_2 \cdot \text{Cu}_2\text{I}_2$.

HERR HAASS describes in the *Berliner Berichte* a simple method of illustrating the existence of the so-called "critical pressure" described in this journal by Carnelley. A small piece of mercuric chloride is placed in a glass tube which is closed at one end, and communicates at the other with a Bunsen pump. So long as the manometer registers less than about 400 mm. pressure it is not possible to melt the mercuric chloride by heating it; the salt passes at once from the solid to the gaseous state. But immediately the pressure rises above about 420 mm. the mercuric chloride melts.

IN studying the condensation products of aldehyde Prof. Lieben has obtained (*Wied. Akad. Ber.*) a new alcohol belonging to the same series as glycerin, viz. $\text{C}_4\text{H}_7(\text{OH})_3$. The new compound, called butenyl glycerin by Lieben, is a syrupy, sweet-tasting liquid, soluble in water, boiling at $172^\circ\text{--}175^\circ$ under a pressure of 27 mm. It forms a triacetin analogous in properties to the natural fats; when heated with oxalic acid its behaviour is similar to that of glycerin: formic acid is produced along with an oily, strongly-smelling substance which has not as yet been fully examined.

PHYSICAL NOTES

MONS. A. ANGOT proposes a new formula for calculating altitudes from barometric observations, based upon that given originally by Laplace. The existing method of calculation from observed monthly or annual means is found, as Plantamour has shown, to be defective, since its results exhibit an uncertainty that varies with the season, an elevated station appearing to be higher by day and in summer than at night or in winter. As an example, when the height of the Great St. Bernard is measured by comparison of barometer observations between that place and Geneva, it would appear that the height of the Great St. Bernard exhibits a diurnal variation of 17 metres in winter and of more than 47 metres in summer; while the mean of the June observations gives a height of 25 metres higher than that found from the January numbers! These anomalies M. Angot explains by the facts that the mean temperature between the stations is not exactly equal to the half sum of the two temperatures, and that the weight of the air between the two stations is on the other hand greater when the mean temperature is low. The rather complicated formula proposed by M. Angot gives the difference in altitude by calculating directly the height of each station above an imaginary plane at which the barometric pressure is equal to 760 millims. No empirical coefficients are needed in this case, the standard constants of Regnault and others for air and aqueous vapour being taken. M. Angot has recalculated from his formula a new set of tables, involving all the corrections that must be applied to the older tables of the Bureau des Longitudes.

IN a recent number of the *Journal de Genève* M. Colladon has pointed out that a poplar or other tall tree may, if its roots strike into damp soil, serve as a lightning-conductor to protect a house; and he thinks he has verified this conjecture by examination of a number of individual cases of lightning-stroke. In the case however where the house stands between the tree and a piece of water, a pond or a stream, the shortest path for the lightning from the tree to the wet conductor may be through the house!

YVON ZOCH has described a new kind of electric dust-figures, which he regards as having an important bearing upon the theory of discharges in vacua, being in opposition to the views of Crookes. Tubes of 1 to 3 centims. diameter, and from 10 to 30 centims. in length, were closed at both ends by corks pierced to receive copper wires. In the tubes were placed various powders, bronze powder being chiefly used in preference to others, which being lighter adhered to the sides of the tube. One wire was then connected with the positive conductor of an electric machine; from the other the repelled electricity dissipated itself into the air. In other cases the discharges of Leyden jars were employed. The experiments were all conducted at atmospheric pressure. When thus treated the bronze powder arranged itself in beautifully-marked ridges or strata, varying in regularity according to the original distribution of the powder. A space free from all traces of powder was observed to surround the positive pole. Usually there was a corresponding accumulation about the negative pole. These ridges or striations may be compared to the stratifications observable in Geissler-tubes; and Herr Zoch shows that variations in the strength of the electric discharges, in the width of the tubes, &c., produce upon these figures similar effects to those they produce on the luminous strize of vacuum tubes. In this present case a mechanical repulsion of the particles lying near the poles undoubtedly takes place; and the author of this research believes that the presence of light at the poles of the Geissler tube may be similarly accounted for on the hypothesis that the luminous regions are those of less density than the non-luminous. Since the bronze powder is heaped up mostly about the negative pole the inference is that at the negative pole of a Geissler tube the residual gas has a greater density than at

any other part. The stratifications produced by electric discharges through flames may be similarly explained; and these researches have an obvious bearing on the structure of Lichtenberg's well-known figures.

MONS. MERCADIER has been devoting some attention to the subject of the photophone, and more particularly to the production of sounds by the simpler forms of the instrument, in which a selenium receiver with its electrical connections is dispensed with. The musical photophone—or, as M. Mercadier chooses to style it, the radiophone—may be described as a sort of optical siren, in which a rotating disk pierced with holes is interposed in the path of a period of rays of light, causing intermittences of regular period varying with the speed of the disk. Our readers will remember that such a beam falling on a simple disk of metal or of hard rubber throws it into vibration, and it emits a note corresponding in pitch with the frequency of the intermittences of the light. In Prof. Bell's actual instrument this "siren" was a heavy disk of brass pierced with holes. M. Mercadier prefers a disk of black paper gummed upon a glass disk in order to get rid of the whistling sounds which even a gentle current of air produces on the brass disk. It may be noted in passing that M. Duboscq has independently constructed similar disks. The receiving disks were fixed in a suitable holder at the end of a short india-rubber hearing-tube. M. Mercadier finds that when opaque disks of zinc, copper, and other substances are employed to receive the beams, very little difference in the loudness of the sounds can be perceived, whether the disks are polished or not. But the thickness of the disks is of great importance, thin ones answering much better than those a little thicker. With transparent laminae such as glass and quartz, M. Mercadier obtains strong effects, whereas Prof. Bell found only feeble results with these substances. The degree of polish is here unimportant also; but a film of smoke or white paint, or of metallic silver on the front of the disk, diminishes its powers, while, on the contrary, the loudness is augmented by blackening the back of the disk. M. Mercadier employed as sources of light the lime-light and flames of petroleum fed with oxygen.

HERR F. KLOCKE has lately discovered an anomalous property in hyposulphite of lead in respect of its action on polarised light. This substance usually exhibits circularly polarised light: but Klocke has found that plates cut perpendicularly to the optic axis, when viewed in the field of a polariscope by parallel rays of light, appear unequally bright, being divided by dark bands into six sectors, of which opposite pairs are equally bright. In convergent light, moreover, the ordinary ring-figure of a uniaxial crystal is not seen, but instead there appears in each sector a figure of the form characteristic of the ordinary biaxial crystal, and having the plane of the optic axes perpendicular to the neighbouring edge of the crystal. The explanation of this curious phenomenon appears to be that there is some anomaly in the molecular structure of the crystals, by virtue of which the six portions are compressed equally each in direction perpendicular to the neighbouring face of the prism.

In the Vienna *Berichte* for June, 1880, Victor von Lang describes a form of dichroscope, in which a small improvement upon the common form has been made. Usually the small square aperture through which light is admitted to the rhomb of spar is fixed rigidly to the tubular holder of the latter. In the new form the square aperture is cut in a diaphragm fastened to an outer tube, which can be rotated round the inner. The advantages gained in permitting the rhomb of spar to be turned independently of the aperture are obvious. A plano-convex lens of small magnifying power is added as usual as an eyepiece at the other end of the rhomb.

M. AMAGAT has experimented on the compressibility of oxygen gas in an apparatus in which the working fluid for transmitting the pressure was mercury. Since the experiments of Regnault it has been commonly assumed that the absorption of the gas by mercury at high pressures and temperatures rendered inexact any such experiments. M. Amagat however finds that the absorption is almost insensible, an oxygen manometer and a nitrogen manometer giving identical indications for several days, even with temperatures varying up to 100°.

MM. HAUTEFEUILLE AND CHAPPUIS have continued their researches on the liquefaction of ozone, which they have lately liquefied in the presence of carbonic acid. They believe the point of liquefaction of ozone to be very near that of carbonic

acid; and on mixing ozonised oxygen with carbonic acid and submitting it in a capillary tube to a slow pressure at a temperature of -23° (obtained by the evaporation of methylic chloride), they obtained a liquid separated by a distinct meniscus from the gas. This liquid was of a clear blue tint, as was the compressed gas above it. If the substance is then allowed to expand gently and immediately compressed, the liquid becomes much more blue, owing to the greater proportion of liquefied ozone. The blue tint thus characteristic of ozone under pressure proves it to be present in the gases which result when the silent electric discharge is passed through carbonic acid gas for some hours.

EDISON has lately patented a "webermeter." This is an instrument for measuring the amount of electric current flowing through a circuit, or in other words a meter for electric currents to tell the number of webers that have been supplied. The name is at least in accordance with the inventor's usual abundant ingenuity.

In the *Comptes rendus* M. Gouy publishes an extract from a memoir presented by him to the Académie des Sciences, on the propagation of light. In this memoir he proposes to examine the particular case of propagation of luminiferous waves, in which, while the direction of the propagation of the movement is constant, the intensity of the waves or of the source of light varies. This problem, which has doubtless been suggested to the author by considerations derived from the photophone, affects the whole question of the measurement of the velocity of light, whether by the methods of occultations of Roemer and Fizeau, or by that of aberrations (in the rotating mirror), as devised by Foucault. The former case only is treated of in M. Gouy's paper. Setting aside at first the case of dispersive media, and restricting the question to isotropic media, M. Gouy investigates mathematically whether the velocity of propagation of the amplitude is the same as that of the wave, and finds that this is the case only for those waves for which the differential equations contain no terms beyond those of the second order—those in which the vibration has virtually attained to the steady condition. For such waves moreover in dispersive media the amplitude is not propagated with the same velocity as the waves themselves, but the amplitude itself varies according to a complex function of the wave-length according to an ascertainable periodic law. If we remember rightly, a similar hydrodynamic investigation of the rate of propagation of waves in water was made some years ago by Prof. Osborne Reynolds, with the result that the effective wave-front only travelled at half the velocity of the steady waves. The inference is that that which physicists usually term "the velocity of light" is only the rate of propagation of the wave-front, which is slower than the true velocity, the retardation being greatest for the vibrations of greatest wave-length.

ANOTHER new property of selenium is claimed as the discovery of M. Blondlot. He states that when selenium is rubbed upon platinum, each metal being connected with a terminal of a capillary electrometer, a current is observed. This current, which is observed to pass through the electrometer from the platinum to the selenium, appears therefore to differ from the tribo-electric currents discovered by Becquerel, and which were always in the same direction as the thermo-electric currents which would have been produced had the surfaces of friction been directly heated. The true thermo-electric current of a selenium-platinum pair is, according to M. Blondlot, from selenium to platinum through the heated junction. One curious point stated by M. Blondlot is that no indication whatever is obtained upon the capillary electrometer by friction between two metals, or between two insulators, or between a metal and an insulator. The electrometer in the selenium experiment indicated a difference of potential about equal to that of one Daniell's cell.

MAGNUS AND TYNDALL found carbonic acid to have a considerable absorbent action on radiant heat. Dr. Lecher (*Wien. Acad. Anz.*) has lately made new observations, especially as to absorption of solar radiation by the carbonic acid in the atmosphere. Experiments with a gas-lamp and glass cylinder first showed that carbonic acid in a length of 214 mm. gave passage to 94.8 per cent. of the radiation; 536 mm. 93.8 per cent.; 917 mm. 89.0 per cent. At Greifenstein, outside of Vienna (chosen for pure air), the sun's rays also were proved to undergo considerable weakening in passage through carbonic acid gas. A layer of this gas one metre thick absorbed about 13 per cent. when the sun had an altitude of 59° ; the number however diminished in proportion as the sun got lower. This shows that the absorption of solar radiation by carbonic acid is selective, and that the

absorbable wave-lengths become more rare the greater the atmospheric layer the rays have already traversed. The author calculates from his experiments the proportion of carbonic acid in the atmosphere, finding it 3·27 in 10,000 parts by volume; a number agreeing so well with results of chemical analysis as to indicate that this is a good way of determining the carbonic acid in the atmosphere and its variations, applicable, too, at heights where direct measurements are impossible.

HERR WINKELMANN proves by experiment (*Wied. Ann.* No. 11) that the heat-conduction of ethylene decreases somewhat with increased pressure. The pressure was varied from 10 to 740 mm. (Comparative experiments with air showed no influence of pressure.) The author explains the phenomenon by the divergence of ethylene from Boyle's law. The action of cohesion-forces between the molecules is indicated by that fact; and this will cause, at each collision, a temporary retardation of the straight movements, which effect will occur oftener the greater the number of collisions (*i.e.* the greater the density). Hence this retardation will increasingly affect the velocity with which two contiguous layers of different temperature exchange the energy of their motions.

A REMARKABLE fall of rain in Austria and neighbouring parts on August 11-15 this year, has been closely investigated by Dr. Hann (*Wien. Akad. Anz.*), on the basis of data from 260 stations in Austria-Hungary, Bavaria, Switzerland, and Saxony. This fall caused the Danube at Vienna to reach (on the 18th) its highest summer level in this century. The rain began in Siebenburgen and south-east Hungary on the 11th, and in general went from east to west. It was most extensive on the 12th, and the heaviest fall was in Salzkammergut and neighbourhood. The rain-area is found to lie on the west and north-west side of the area of lowest air-pressure, and to stretch westwards far over the border of the minimum region. Near the centre of lowest pressure the precipitation was much less than in several parts distant from it. The non-existence of a minimum-producing power of rainfall (contrary to common views), and the incapability of so great rainfall as that in the present case attracting a minimum and influencing its propagation, are noteworthy. The general conclusion arrived at is that no relation is demonstrable between barometric variation and rainfall; the fall of the barometer does not primarily depend on the rainfall, and is not perceptibly influenced by it. Dr. Hann finds this confirmed by an examination of several other heavy rainfalls in their relation to distribution of air-pressure.

THE salt and the ice in cryohydrates have been regarded by Prof. Guthrie as in chemical combination. In 1877 Herr Pfaunder expressed the view that cryohydrates were merely mixtures of salt and ice. This view is also maintained by Herr Offer, who in a recent paper to the Vienna Academy raises various objections to the existence of cryohydrates as chemical compounds. The numbers expressing the quantities in which the water unites with the salts in various cryohydrates, indicate no stoichiometric law, and tell much rather in favour of chemical mixtures. No cryohydrate forms a clear and pure crystal, but always an opaque confused crystalline mass. The phenomena which occur when cryohydrates are brought into alcohol and into water are considered to be against Prof. Guthrie's view. The heat-absorption of cryohydrates in dissolving, as compared with that of the salt and ice separately, only presents differences which lie within the errors of observation. Further, Herr Offer compared the specific gravity of several cryohydrates with those of their constituents, and found pretty close agreement.

FROM recent magnetic researches Herr Auerbach (*Wied. Ann.* No. 11) finds the temporary magnetism of cylindrical bodies, *ceteris paribus*, proportional to the mass; greater the greater the length; the less the thickness; the greater the density; dependent only on form, not on size; in the case of nickel, according to density and force, a quarter to half as much as in iron. It increases with magnetising force, first proportionally, then (except with very small density) more quickly, and at last more slowly. The quick increase is greater the denser the body. The turning point is, for the same density, at the same place, but with stronger forces the greater the density; for magnetic saturation of powders extremely strong forces are necessary. Herr Auerbach theorises on these results.

ANOTHER paper on magnetism in these *Annalen* is by Herr Baur, and deals with the "function of magnetisation" for very small magnetising forces; the influence of temperature on it;

the magnetisability of iron at very high temperatures; Gore's phenomenon; and the function for varieties of iron. Among other results, the smaller the magnetising force the greater is the influence of temperature on the function in question. Up to a certain force the function increases with increase in temperature, but beyond that it decreases. With weak forces the temporary magnetic moment rises quickly (with rise of temperature) to a maximum at red glow, then sinks quickly to *nil*; with strong forces it gradually sinks, with rise of temperature, to a very low value at red glow. With increased magnetic force Gore's phenomenon becomes more intense and prolonged, and it occurs at a higher glow. In ordinary iron the function of magnetisation reaches its maximum very quickly, in iron filings later, and in electrolytic iron very late.

GEOGRAPHICAL NOTES

THE glacier of the Byeloukher Mountain, the chief summit of the Siberian or Great Altay, which has not been visited by men of science during the last fifty years, was recently explored by an expedition engaged in the study of the life of the West Siberian natives. After having crossed the 9000 feet high Alps of the Tchouya, the explorers descended into the pretty and wealthy broad valley of the Tchouya, whence, following the Arkhyt River, they soon reached the foot of the mighty Berel glacier. The glacier, which forms in its lower parts a *mer de glace* two miles long and 2800 feet wide, was accurately explored and surveyed during a week by the expedition from its lower end to a great ice-fall, where the travellers were compelled to stop their work before a moving wall of ice, while mighty masses of snow fell, one after the other, on the glacier from the neighbouring mountains. After having surveyed the glacier and made several drawings of the severe scenery which it affords, the travellers returned to the valley of Ouimon, and thence to the civilised towns.

THE astronomical determinations of positions which were made by M. Pyevtsoff during his journey from Khobdo through Mongolia to Kalgan, and from Ourga to Kosh-agatch, are published by Col. Scharnhorst in the last number of the *Izvestia* of the Russian Geographical Society. They are most welcome, as they come from a country where exact determinations are very scanty. —The same fascicule of the *Izvestia* contains M. Larionoff's catalogue of seventy-five determinations of heights in the northern and eastern parts of the province of Kouldja and in the mountains which border it north and east; and M. Severtsoff's map of his route on the Pamir Rang-koul, south-east of the Lake Kara-koul.

THE Russian travellers who have been engaged in the exploration of Central Asia are now returning to St. Petersburg. Col. Prshevsky is expected every day, and the Russian Geographical Society, at its last meeting (December 15), elected the indefatigable traveller an Honorary Member. M. Potanin is already at St. Petersburg, and will soon give a lecture on his journey to Western Mongolia, as also M. Pyevtsoff, who travelled with merchants from Biysk to Khou-khou-khoto, and who during his journey collected much material for the correction of the map of Mongolia. M. Mushketoff, who has explored the glacier of Zarafshan (*NATURE*, vol. xxiii. p. 44), gave a lecture at the last meeting of the Russian Geographical Society on his excursion. This traveller, contrary to M. Severtsoff's experience, did not find in the Thian-Shan any traces of the glacial period.

THE *Kouban News* announces the appearance, in the Sea of Azoff, of a new little island, some 150 feet in diameter, and 10 feet above the level of the water. Its appearance was accompanied with a kind of marine eruption. It is 150 brasses distant from the shore, where a crevice has appeared.

THE organisation of the Polar meteorological station on the Lena is being actively carried out by Prof. Lentz. The director of the station will be M. Yurgens.

PROF. NORDENSKJÖLD is again thinking of fresh enterprises. At present a ship is being built at the Lena estuary, in which he intends to start on a new Arctic expedition in the summer of 1882.

PRINCE BORGHESE, the Italian African traveller, has arrived near Tripolis from Wadai. This is the first time that a traveller from Darfur has reached the Mediterranean by way of Wadai and Bornu.

THE Leipzig publishing firm of Ferd. Hirt and Son announce that Major Serpa Pinto's great African work of travel will be published in January, 1881.